CLAIMS

1. A method of reinforcing an embedded cylinder pipe (1) by applying a composite structural reinforcement within the pipe through in situ stratification of at least one band (3) of reinforcement fibers and a resin or a resin including matrix comprising the steps of

- applying said band onto a contact area (4) on an internal face (2) of said pipe by means of a contacting member (40);

- moving said contacting member (40) along an helical path so that said contact area follows said path;

- moving a main pressing member (50) behind said contacting member (40) along said path, to apply pressure to said band (3) in a main pressure area (5) separated from said contact area (4).

2. The method of claim 1, wherein the band (3) is composed principally of carbon fibers.

3. The method according to claims 1 or 2 wherein the band (3) is a fabric, for example an unidirectional fabric.

4. The method according to any of preceding claims wherein the band (3) is preimpregnated with at least a resin or resin including matrix.

5. The method according to any of preceding claims comprising the step of moving a coating member (80) along said helical path and coating the internal face (2) of said pipe with a resin or resin including matrix in a coating area forward said contact area (4).

6. The method according to any of preceding claims comprising the step of moving a coating member (80) along said helical path and coating the previously applied band (3) on said internal face (2) of said pipe with a

resin or resin including matrix in a coating area (8) behind said contact area (5) and applying pressure through a secondary pressing member (80) to said band (3) in a secondary pressure area (8) situated behind said main pressure area (5).

7. The method according to claim 5 and/or claim 6 where the resin or the resin including matrix is obtained by mixing at least an unpolymerized resin and a hardening agent just before said coating step.

8. The method according to any of preceding claims where:

- said band (3) is fed to contact area (4) of internal face (2) of said pipe at a first running speed, V_1;

- said band (3) is pressed against the internal face (2) of said pipe in the main pressure area (5) at a second running speed, V_2;

where said second running speed, V_2,is less than first running speed V_1, and at least 90 % of V_1, in particular at least 95%.

9. The method according to claim 8 where V_2 is 98% to 99% of V_1.

10. The method according to any of preceding claims where the forward moving speed along the axis of the pipe, V_F, of the stratification process is driven by said second running speed, V_2.

11. The method according to claim 10 where said forward moving speed, V_F, is about,

$$V_F = V_2 * W/ (2 \Pi * R * N)$$

where W is the width of the band;

R is the radius of the internal side of said pipe;

N is the number of band layers of the composite structural reinforcement.

12. The method according to any of preceding claims where contacting member (40) and/or main pressing member (50) are radially adjustable (a) so as to be kept in contact with the internal face (2) of said pipe.

13. The method according to any of preceding claims where contacting member (40) includes a roller (41), driven by a wheel (42) contacting the internal face (2) of said pipe before applying the composite structural reinforcement, and where the peripheral speed (V_1) of said roller (41) is increased compared to the peripheral speed (V_2) of said wheel (42).

14. The method according to any of preceding claims where the band (3) is unwinded from a roll (71) prior to contact the internal face (2) of said pipe.

15. The method according to claim 14 where the tension of the unwinded band (3) is regulated so that the band (3) is stress free when applied onto contact area (4).

16. The method according to any of preceding claims where the contact pressure in contact area (4) and/or the pressure in main pressure area (5) are regulated and remain roughly constant along the helical path.

17. A machine for reinforcing an internal side (2) of an embedded cylinder pipe (1) with a composite structural reinforcement, said composite structural reinforcement comprising at least a band (3) of reinforcement fiber and a resin or resin including matrix, said machine comprising:

- a contacting member (40) capable of applying the band (3) to the internal face (2) of said pipe;

- a pressing member (50) capable of applying pressure to said band (3) against the internal face (2) of said pipe;

- a moving member (20, 90) capable of moving said contacting member (40) and pressing member (50) along an helical path;

where said contacting member (40) and said pressing member (50) are angularly shifted (α) one from the other.

18. The machine of claim 17 comprising further a band providing member (70), comprising for example a band roll (71).

19. The machine of claim 18 where the rotating speed of said band roll (71) is regulated through a rotating device (74), such as a jack or an engine.

20. The machine of claims 18 or 19 where said band providing member (70) includes at least a drive and tensioning roller (72).

21. The machine of claims 17 to 20 where said moving member comprises a rotating member (20) which rotation axis (21) is movable so as to match the longitudinal axis of said pipe and a forward moving member (90).

22. The machine of claims 17 to 21 where said rotating member (20) includes a rotating motor (22) linked to a vertically sliding member (25).

23. The machine of claims 21 or 22 where said rotating member (20) includes a rotating joint (23) linked to a rotating motor (22).

24. The machine of claims 17 to 23 where said contacting member (40) and said pressing member (50) are part of a single rotating unit (30), said rotating unit (30) comprising a shaft (31) linked to a rotating member (20).

25. The machine of claims 17 to 24 further comprising a coating member (80), comprising for example a coating roller (81), capable of coating the internal

face (2) of said pipe, linked to the moving member, and being angularly shifted from both contacting member (40) and pressing member (50).

26. The machine of claim 25 where said coating roller (81) is fed by a plurality of feeding members (83), comprising for example a plurality of tubes linked to at least a tank (84, 85).

27. The machine of claim 26 including at least two separate tanks (84, 85), where a first tank is suitable to contain unpolymerized resin (85) and a second tank (84) is suitable to contain an hardener agent, and where said unpolymerized resin and hardener agent are mixed close to said coating roller (81).

28. The machine of claims 17 to 27 where said contacting member (40) and/or said pressing member (50) are attached to a shaft (31) through radially extendable arm(s) (60).

29. The machine according to claim 28 where said radially extendable arm (60) is radially regulated through actuating a pneumatic jack (62).

30. The machine of claims 17 to 29 where said contacting member (40) and/or said pressing member (50) comprise a roller (41, 51) and/or a blade and/or a brush.

31. The machine of claim 30 where contacting member (40) comprises a roller (41) driven by a wheel (42) suitable to contact said internal face (2) of said pipe, said wheel (42) being linked to said roller (41) with a peripheral speed increase member (45).

32. The machine of claims 17 to 31 including a forward moving member (90) which includes a driving wheel (91) suitable to contact the internal face (2) of said pipe, said driving wheel (91) being moved by a motor (93) through a stabilization member (95).

33. The machine of claim 32 where said stabilization member (95) comprises two inclined wheels (96) situated from each side of driving wheel (91) and capable of contacting the internal face of the pipe, said wheels being linked to arms (97) in an adjustable position along said arms (97).

34. The machine of claims 17 to 33 which further includes a front wheel (94).

35. The machine of claim 34 which further includes a gyroscope, for example a pendulum, and a controller unit activated by said gyroscope and orientating the front wheel (94) to keep the horizontal position of the machine.